Summary of Safety and Effectiveness Data

I. GENERAL INFORMATION

Device Generic Name:	Diagnostic/Ablation Catheter and Accessories
Device Trade Names:	Blazer II XP™ Cardiac Ablation Catheter EPT-1000 XP™ Cardiac Ablation Controller (with software version 3.12)
Applicant's Name and Address:	Boston Scientific Corporation EP Technologies, Inc. 2710 Orchard Parkway San Jose, CA 95134
Date of Panel Recommendation:	N/A
Premarket Approval Application (PMA) Number:	P020025
Date of Notice of Approval to Applicant:	August 25, 2003

Device and Accessory Model Numbers:

Family Name	Model Number	
Blazer II XP™	4500T	4500THN4
	4500TL	4790TH
	4500TM	4790THM
	4500TK2	4790THK2
	4500TMK2	4790THM2
	4500TMN4	4790THN4
	4500TN4	4770T
	4790T	4770TL
	4790TL	4770TM
	4790TM	4770TK1
	4790TK1	4770TK2
	4790TK2	4770TMK2
	4790TMK2	4770TMN4
	4790TMN4	4770TN4
	4790TN4	4770TH
	4500TH	4770THM
	4500THM	4770THK2
	4500THK2	4770THMK2
	4500THMK2	4770THN4
EPT-1000 XP™ Cardiac Ablation Controller	Model 800XP, with software version 3.12	

Explanation of Model Numbers:

For the Blazer II XP™ catheters, the first four digits of the model number refer to the length and shape of the distal tip electrode. Model 4500 catheters are the 8mm standard tips, model 4790 are the 10mm standard tips, and model 4770 are the 8mm contour tips. The letters located after the first four digits in the model number signify the length and torque of the distal tubing segment, and the type of curve for the catheter. For example, the 4500T has a standard distal tubing length, standard torque, and a standard curve. The 4500TH is the same catheter, but with high torque ("H" signifies high torque). The 4500THK2 is the same as the 4500TH, but with a different curve, K2. Available distal tubing lengths are standard (T), medium (TM), and extended (TL). Available curve types are standard, K2 (large), N4 (asymmetric), and NR1 (asymmetric reach).

Related Pre-Market Applications

The Blazer II XP™ catheter is derived from the Blazer II™ catheter approved under P920047. The major difference is the length of the tip electrode in the present Blazer II XP™ catheter (8 mm and 10mm compared to 4 mm and 5mm in previous devices). Further, the predecessor to the EPT-1000 XP™ controller was also approved under P920047. Relevant design specifications of the previous device were maximum power output of 50W with maximum temperature setpoint of 90°C. For more information on the data that supported the related application, please refer to the summary of safety and effectiveness data available on the FDA CDRH Internet HomePage located at http://www.fda.gov/cdrh/pmapage.html. Written request for this information can also be made to the Dockets Management Branch (HFA-305), FDA, 5630 Fishers Lane, rm. 1061, Rockville, MD 20852.

II. INDICATIONS FOR USE

The Boston Scientific Corporation Blazer II XP™ Cardiac Ablation Catheter is indicated for use with the EPT-1000 XP Cardiac Ablation Controller and Accessories for the treatment of sustained or recurrent type I atrial flutter in patients age 18 or older.

The EPT-1000 XP™ Cardiac Ablation Controller and Accessories are indicated for use in conjunction with standard and high power catheters for cardiac ablation procedures.

III. CONTRAINDICATIONS

Do not use this device:

- in patients with active systemic infection;
- via the transseptal approach in patients with left atrial thrombus or myxoma; and
- via the retrograde approach in patients with aortic valve replacement.

IV. WARNINGS AND PRECAUTIONS

The warnings and precautions can be found in the Blazer II XP™ Cardiac Ablation Catheter Directions for Use and the EPT-1000 XP™ Cardiac Ablation Controller & Accessories Operator's Manual.

V. DEVICE DESCRIPTION

The Boston Scientific EPT-1000 XP™ Cardiac Ablation System is used to deliver radiofrequency (RF) energy to selected endocardial sites. As referenced in the above table on Device and Accessory Model Numbers, the system consists of two main components:

A. EPT-1000 XP™ Cardiac Ablation Controller, and

B. Blazer II XP™ Cardiac Ablation Catheters

For catheter ablation procedures, the device components require the use of a High Power Automatic Personality Module (XP APM), accessory cables, an optional footswitch and graphics software previously approved under P920047.

Description

A. EPT-1000 XP Cardiac Ablation Controller (RF Generator) with software 3.12

The EPT-1000 XP™ RF Generator is a modified version of the commercially available EPT-1000™ Cardiac Ablation Generator. Both devices are line-powered RF power generators, which supply and control the RF power output delivered to a cardiac ablation catheter via the appropriate Automatic Personality Module (APM or XP APM).

The EPT-1000 XP™ RF Generator is designed to produce a user selectable constant temperature or constant RF power output to the range of 0 to 50 watts or 0 to 100 watts, depending on catheter type, into a nominal tissue impedance of 100 ohms. The system can deliver up to 100 watts only when the EPT-1000 XP™ is connected to a Blazer II XP™ catheter with its unique, proprietary identification code resistor. One hundred watts is the maximum user selected power that may be delivered.

The RF Generator operates in a monopolar mode between a single active electrode at the tip of the ablation catheter and two large surface area return Dispersive Indifferent Patch (DIP) electrodes applied externally on the skin. The indifferent electrodes may be any standard electrosurgical indifferent electrodes that meet the requirements of ANSI/AAMI Standard HF-18 for Electrosurgical Devices. The RF waveform is sinusoidal at a nominal frequency of 500 kHz.

The EPT-1000 XP™ RF Generator operates in one of two control modes: power control mode or temperature control mode.

B. Blazer II XP™ Cardiac Ablation Catheters

The Blazer II XP™ Cardiac Ablation Catheters (Blazer II XP™) are specifically designed to utilize the maximum power capability (up to 100 watts) of the EPT-1000 XP™ RF Generator. These catheters contain a unique proprietary code which the EPT-1000 XP™ RF Generator must recognize in order to allocate power up to 100W. Note that catheters not containing this unique, proprietary identification code are identified by the EPT-1000 XP™ system as capable of delivering up to 50 watts maximum power only.

The Blazer II XP™ Catheter is a torquable, bi-directionally steerable catheter. The catheter is ethylene oxide sterilized and designed for single-use only

The table below summarizes the basic specifications of the Blazer II XP™ Cardiac Ablation Catheters.

Blazer II XP™ Cardiac Ablation Catheter Specifications

Description	Specification
Electrode Tip	
Straight Tip	8 F/8 mm 8 F/10 mm
Contour Tip	8 F/8 mm
Electrode Spacing	
Tip-to-First-Ring	1.5 – 5.0 mm
Ring-to-Ring	2.5 and 5 mm
Electrode Configuration	Quadripolar (4 Electrodes)
Ring Electrode Width	1.25 mm
Deflection	
Symmetric	Up to 270° in opposite directions
Asymmetric	Up to 180° in one direction, 270° in opposite direction
Curve Configurations	
Symmetric	Standard, K2
Asymmetric	N4, NR1
Catheter Length	60 cm to 130 cm
Distal Tubing	
Length	6.6 cm to 15 cm
Stiffness	Soft, Firm
Catheter Shaft Diameter	6 F, 7 F, and 8 F
Torque Attributes	High Torque

C. XP APM

The XP APM provides RF filtering to allow continuous electrogram recording during RF power delivery via the catheter tip electrode. It passes RF energy (at 500 kHz) from the RF

Generator to the patient via the catheter and two Dispersive Indifferent Patch (DIP) electrodes.

D. EPT Graphics Software

The EPT Graphics Software, version 1.06, allows the user to record data pertinent to an ablation procedure including RF power output, impedance and temperature. The data is stored on the hard drive and can be transferred to a diskette or paper copy record. The software, which is compatible with all models of EPT-1000™ Cardiac Ablation Systems, includes three additional error display codes that are specific to the EPT-1000 XP™ Controller.

E. Footswitch (optional)

A Footswitch is provided for optional control of the RF energy output when the user is not in close proximity to the RF Generator. The 10-foot cable allows the user to stand at the catheterization table near the patient and not require a second person for starting/stopping RF energy.

VI. ALTERNATIVE PRACTICES OR PROCEDURES

Alternative therapy for atrial flutter includes direct surgical ablation, use of drugs for arrhythmia control, antiarrhythmia pacing, and other approved RF ablation catheters.

VII. MARKETING HISTORY

The Boston Scientific/EP Technologies EPT-1000 XP™ Cardiac Ablation System is marketed in Canada, Europe, South America, Africa, and Asia.

The product has not been withdrawn from marketing in any country for any reason related to safety or effectiveness.

VIII. POTENTIAL ADVERSE EFFECTS OF THE DEVICE ON HEALTH

Potential adverse events, which may be associated with catheterization and ablation, include:

• air embolism • allergic reaction (including anaphylaxis) • anemia • angina • arrhythmias, including exacerbation of pre-existing atrial fibrillation • arterial or pulmonary embolism • arterial / venous thrombosis	• hemothorax • hypotension • increased phosphokinase level • infection • laceration • myocardial infarction • nerve palsy or weakness • pericarditis

• arterial-venous fistula • atrioventricular node damage (transient/permanent) • atypical flutter • back pain and / or groin pain • cardiac perforation • cardiac or respiratory arrest • cardiac thromboembolism • catheter entrapment • cerebral vascular accident • chest pain / discomfort • complete heart block • complications of sedative agents (e.g. aspiration pneumonia) • congestive heart failure • death • effusion (pericardial / pleural) • endocarditis • hematoma / bruising • hemoptysis • hemorrhage	• phrenic nerve damage/diaphragmatic paralysis • pleural effusion • pleurisy • pneumothorax • pulmonary edema • pseudoaneurysm • radiation exposure • seizure • sinoatrial node damage • skin burn (defibrillator / cardioverter / radiation) • tamponade • temporary complete heart block • thrombi • thromboembolism • transient ischemic attack (TIA) • valvular damage/insufficiency • vascular bleeding • vasovagal reactions • visual blurring • worsening chronic obstructive pulmonary disease

For actual adverse events observed during the clinical study (within 7 days post-ablation), please refer to Table 13 below.

IX. SUMMARY OF PRECLINICAL STUDIES

1. Laboratory Studies – Blazer II XP™ Cardiac Ablation Catheters

Testing can be divided into three categories: 1) Testing performed to ensure product safety (reliability, biocompatibility, and sterilization); 2) Testing performed to ensure adequate performance (electrical and mechanical); and 3) Testing to validate the packaging system for microbial protection (packaging integrity and shelf life).

1a. Reliability

Reliability testing was performed for the Blazer II XP™ catheter. In the tests described below, the catheters were double-sterilized prior to testing.

Table 1 – Reliability Testing of Blazer II XP™

Test	Sample Size	Acceptance Criteria	Results
Pull Test Tip Electrode to Distal Tubing	10	No failure before 5 lbs.	passed*
Pull Test Handle to Catheter Main	29	No failure before 5 lbs.	passed

Body Tubing			
Thermal Response of Tip Electrode	10	Time constant less than 1 second	passed
Thermal Repeatability of Tip Electrode	2	Time constant less than 1 second after 100 RF applications of 150W power	passed
Physico-Chemical Properties	28	Within USP limits after exposure to 100 RF applications of 150W power	passed

*In documenting results, "passed" means that all samples passed.

Tests not conducted

The primary difference between the Blazer II XP™ catheter in the subject PMA and the Blazer II™ catheter approved under P920047 is the length of the tip electrode (8mm and 10mm vs. 4mm and 5mm, respectively). Due to the similarities between the two catheters, the following reliability tests were not repeated in the subject PMA:

- Pull Test Distal Tip Electrode to Steering System
- Pull Test Signal Wire to Ring Electrode
- Pull Test Distal Tubing to Main Body Tubing
- Pull Test Steering Wire to Catheter Handle
- Torque Transmission

1b. Mechanical Performance

Mechanical performance testing was performed for the Blazer II XP™ catheter. In the tests described below, the catheters were double-sterilized prior to testing.

Table 2 – Mechanical Performance Testing of Blazer II XP™

Test	Sample Size	Acceptance Criteria	Results
Buckling Force	29	< 340 g	passed
Steering Mechanism Actuation	22	Angular rotation of steering lever and tension control knob shall be per specifications upon deflection	passed

Tests not conducted
Due to the similarities between the Blazer II XP™ catheter and the approved Blazer II™ catheter, the following mechanical performance tests were not repeated in the subject PMA:

- Twist Test (no mechanical failures after 10 revolutions)
- Steering Life Cycle (no mechanical failures after 100 cycles)
- Bending

1c. Electrical Performance
Electrical performance testing was conducted on Blazer II XP™ catheters that were double-sterilized.

Table 3 – Electrical Performance Testing of Blazer II XP™

Test	Sample Size	Acceptance Criteria	Results
Dielectric	20	Withstand 500V at 60 Hz for 60 seconds without leakage current or electrode circuit failure	passed
Continuity	20	15 – 35 kΩ for thermistor, 10Ω for each electrode circuit at room temperature	passed
RF Leakage (catheter body)	20	< 63 mA_{rms}	passed
RF Leakage (ring electrodes)	20	< 122 mA_{rm}	passed
RF Leakage (tip electrode)	20	nominal	passed
RF Power Transmission Capability (catheter body heating)	2	Temperature of outer surface of catheter body < 44°C in saline and < 55°C in air	passed
RF Power Transmission Capability (multiple RF cycles)	10	No electrical failures after 100 RF applications at 150W for at least 2 minutes each	passed

1d. Biocompatibility of Blazer II XP™
Since the Blazer II XP™ catheter and the Blazer II™ catheter approved under P920047 have the same patient blood contacting materials and there was no change in processing, biocompatibility was not re-validated.

The following table lists the patient blood contacting materials that were tested in accordance with the Tripartite Biocompatibility Guidance for Medical Devices and submitted under P920047. All materials are classified as short duration, direct blood path, and externally communicating per ISO 109993-1.

Table 4 – Patient Blood Contacting Materials of the Blazer II XP™

Component	Material Description
Ring Electrode	90% Platinum, 10% Iridium
Distal Tip (Ablation) Electrode	90% Platinum, 10% Iridium
Distal End Tubing	Polyurethane or Pebax
Main Body Tubing	Coextrusion of Pebax & Stainless Steel Wire Braid
Tube Bonding Adhesive	Cyanoacrylate Ester
Ring Electrode Retaining Adhesive	Urethane Methacrylate, UV Curable

1e. Shelf Life of Blazer II XP™

The Blazer II XP™ catheter sterile packaging is identical to that of the Blazer II™ catheter approved in PMA P920047. The shelf life claim of three years, as demonstrated by physical testing of the Blazer II™ catheters approved under P920047, is acceptable for the Blazer II XP™.

1f. Sterilization of Blazer II XP™

Since the components and the packaging of the Blazer II XP™ are identical to that of the Blazer II™ catheter approved in PMA P920047, the sterilization validation of the Blazer II™ is acceptable for the Blazer II XP™.

As part of the sterilization validation, bioburden was measured after fractional, half, and full cycles of sterilization. The Half and Full cycles were repeated in triplicate. Product sterility test specimens were harvested after a fractional cycle. Product test specimens were gauze sponges and "J" guidewires. Fractional cycle product sterility testing used twenty units each of Trypticase Soy Agar, (TSA) and Fluid Thioglycollate Medium, (FTM) growth media. No indigenous organisms were found to have greater resistance than the biological indicator (BI).

Three repetitions of the Half cycle testing were performed. There was no growth on any of the samples after 7 or 14 days, demonstrating that the sterilization process delivers a minimum six log reduction of the microbial challenge at one-half the gas exposure dwell time.

2. Laboratory Studies – EPT-1000 XP™ Cardiac Ablation Controller & Accessories

Based on the modifications made to the EPT-1000 controller approved in PMA P920047 to create the EPT-1000 XP™ controller, pre-clinical testing included electrical safety,

performance, and software verification and validation related to the increase in RF power output capability to 100 W.

2a. Performance Verification

The following table summarizes the performance testing on the EPT-1000 XP™ with software version 3.12.

Table 5 – Verification Testing of the EPT-1000 XP™ with Software 3.12

Test	Sample Size	Acceptance Criteria	Results
Temperature control	1 generator and 3 catheters	Prevent RF delivery if measured temperature is not within 31°C –41°C	passed
Temperature control	1 generator and 3 catheters	Control measured temperature within ± 3°C	passed
Power shutdown	1 generator and 3 catheters	Shutdown power each time set temperature is exceeded	passed
Low impedance shutdown	1 generator and 3 catheters	Shutdown power if impedance is less than 25Ω or 50 Ω depending on catheter type	passed
High impedance shutdown	1 generator and 3 catheters	Shutdown power if impedance is greater than 300 Ω	passed
Temperature shutdown	1 generator and 3 catheters	Shutdown if measured temperature exceeds setpoint value by 5°C for more than 4 seconds	passed
Temperature shutdown	1 generator and 3 catheters	Shutdown if temperature cutoff is exceeded for more than 1 second	passed
Calibration function	1 generator and 3 catheters	Temperature and impedance settings measured correctly	passed
Chassis, isolation, grounding, and leakage	1 generator	Leakage < 100 μA and > 500 μA for specified conditions	passed
Isolated leakage source current	1 generator	Leakage for distal tip, temperature ports, and indifferent electrode < 10 μA and < 50 μA for specified conditions	passed
Isolated leakage sink current	1 generator	Leakage for distal tip, temperature ports, and indifferent electrode < 50 μA for specified conditions	passed
EMC / EMI	1 generator	Per EN 61000-4 series, EN 55011, EN 1000-4-2	passed

2b. EPT-1000 XP™ Software Verification and Validation

The most significant change in the software for the EPT-1000 XP™ was the power available for ablation. The software was modified to limit the power and temperature settings for the controller to 100 W and 80°C for Blazer II XP™ catheters. Standard temperature-sensing catheters and non-temperature sensing catheters are limited to 50 W

maximum power and 90°C. The software for the EPT-1000 XP™ was verified and validated by safety and performance testing.

3. Animal Studies

In-vivo (animal) testing was performed with the EPT-1000 XP™ Cardiac Ablation System and Blazer II XP™ Catheters to verify that the devices met the basic design and performance criteria as a therapeutic and diagnostic product.

The EPT-1000 XP™ Cardiac Ablation System met its design specifications in terms of signal quality, ability to pace, lesion repeatability, and controlling power to maintain a preset temperature for all test article catheters. The EPT-1000 XP™ Cardiac Ablation System also met the design specifications in an *in vivo* test setup when the catheter distal tip electrode is completely exposed to blood (i.e., no tissue contact) and maximum radiofrequency (RF) power is delivered to the distal tip electrode. The average temperatures for all lesions made with the 8F/8 mm straight, 8F/8 mm contour, and 8F/10 mm straight Blazer II XP™ catheters were less than 50°C, demonstrating sufficient convective cooling of the blood to maintain low electrode temperature despite maximum power levels. No thrombus or coagulum was observed after any radiofrequency (RF) application, whether at 150 Watts or 100 Watts.

X. SUMMARY OF CLINICAL STUDY

1. Objective

The objective of the study was to evaluate the safety and efficacy of the Blazer II XP™ Cardiac Ablation Catheter and EPT-1000 XP™ Cardiac Ablation Controller and Accessories for radiofrequency ablation of sustained or recurrent type I atrial flutter.

2. Study Design

The study was a prospective, multi-center, single-arm study using objective performance criteria and historical control data from the medical literature. Clinical efficacy and safety assessments were performed at one, three and six months and at one and two years following the index procedure.

3. Study Endpoints

The primary endpoints for the study were as follows:

Acute Procedural Success – defined as complete bi-directional isthmus block with non-inducible type I atrial flutter with only the use of the Blazer II XP™ Cardiac Ablation Catheter and EPT-1000 XP™ Cardiac Ablation Controller and Accessories as assessed at the end of the ablation procedure.

Chronic Effectiveness Success – defined as demonstration of Acute Success and continued absence of targeted type I atrial flutter for the first six months after the ablation procedure.

Procedural Safety – defined by the absence of serious complications associated with the use of the investigational device within seven days of the ablation procedure.

Objective Performance Criteria (OPC):
Objective performance criteria (OPC) were prospectively established for all atrial flutter studies by FDA, based on prior experience with supraventricular tachycardia (SVT) ablation studies and consideration by the FDA Circulatory System Devices Panel. The OPC are defined below:

Table 7 - Objective Performance Criteria for Atrial Flutter Ablation

Endpoint	OPC	
	%	One-sided 95% Confidence Bound[1]
Acute Success	86%	80%
Major Complications	3%	7%
Six-Month Success	86%	80%

[1]Exact binomial using a commercially-available software package.

4. Patient Accountability
The table below documents the accountability of patients throughout the study.

Table 8 – Patient Accountability

Patients enrolled in the study	250
Patients not ablated	0
Patients ablated with EPT-1000 XP™ Cardiac Ablation System	250
Patients ablated only with EPT-1000 XP™ Cardiac Ablation System	243
Patients ablated with EPT-1000 XP™ Cardiac Ablation System and non-investigational catheter*	5
Patients ablated only with non-investigational catheter	2

* Patients were first ablated with the EPT-1000 XP™ Cardiac Ablation System only. If flutter procedure could not be completed, then physicians used another catheter to complete the procedure. These patients were considered acute failures.

5. Patient Demographics
The majority of patients in the study are male (83%, N = 205/243). The average age of the male patients is 60.5 ± 11.1 years. There are 42 (17%) females enrolled in the study, with an average age of 63.4 ± 12.4 years.

6. Results

6a. Intraprocedural Data
The table below describes the intraprocedural data:

Table 9 – Intraprocedural Data (N = 209*)

Description (N)	Mean ± SD	Range
Total # of RF Applications / procedure (N = 209 procedures)	11.5 ± 10.6	1.0 - 86.0
Total Duration of RF Applications (minutes) (N = 209 procedures)	14.6 ± 12.1	2.0 - 74.9
Duration per delivery (seconds) (N = 2405 RF applications)	75.9 ± 37.4	11.0 - 120.0
Maximum Set Power (Watts) (N = 2405 RF applications)	76.9 ± 17.1	30.0 - 100.0
Average delivered power (Watts) (N = 2405 RF applications)	54.3 ± 20.5	6.4 - 96.7
Maximum Set Temperature (°Celsius) (N = 2405 RF applications)	64.2 ± 4.8	45.0 - 80.0
Average delivered temperature (°Celsius) (N = 2405 RF applications)	54.6 ± 6.3	40.5 - 77.9

* Based on RF diskette data received

- RF Application with time set < 6 seconds, temperature set < 6 degrees or duration < 11 seconds are excluded from the analysis
- Maximum power allowed is 100 watts, Maximum temperature allowed is 80° C

The procedure and fluoroscopy times are shown in Table 10.

Table 10 – Fluoroscopy/Procedure Index Times (N = 234)

Description	Number of Procedures	Mean (±SD) Duration	Range
Total Procedure (hours)	234	2.1 (±1.3)	0.3 – 9.8
Ablation Time (hours)	231	0.7 (±0.7)	0.03 – 4.5
Total Fluoroscopy (minutes)	232	28.5 (±20.2)	2.8 – 129.0
Ablation Only Fluoroscopy (minutes)	222	14.8 (±13.8)	0.6 – 102.0

6b. Acute Success

Acute success evaluation was based on 250 patients treated with the Blazer II XP™ Cardiac Ablation Catheter and EPT-1000 XP™ Cardiac Ablation Controller and Accessories. The table below describes the information:

Table 11 – Acute Ablation Outcomes (N=250)

	# Success / # Patients Ablated	Percentage (one-sided 95% confidence bound)[1]
Acute Success	235/250	94.0% (91.5%)

[1] Exact binomial using a commercially-available software package.

6c. Freedom from Atrial Flutter Recurrence at Six-Month Follow-Up

Freedom from atrial flutter recurrence was evaluated in patients in whom bi-directional isthmus conduction block (BDB) and non-inducibility of atrial flutter (AFL) post ablation was achieved and were considered evaluable for an assessment of long-term (6-month) success. Based on these criteria, information was available on a total of 151 patients. Results are described in Table 12 below.

Table 12 – Freedom from Atrial Flutter at 6 months

Description	N
Patients ablated **only** with EPT-1000 XP™ System and successful BDB and AFL non-inducibility (Acute Success)	151
Number of patients free from recurrence	145 (96.0%)
Number of patients with recurrence of atrial flutter	6 (4.0%)

The patients were classified as "evaluable at 6 months" and "not evaluable at 6 months." There were also 30 patients of the total 250 patients that had not completed the 6 month follow-up.

Reasons that patients were classified "not evaluable:"

- **Treatment with anti-arrhythmic therapy = 31 patients**
  - **This was defined as treatment with Class 1A, 1C or III at both the one-month and three-month, or at the 6 month follow-up. The rationale was that this treatment might suppress the recurrence of atrial flutter and obscure the actual rate of recurrence.**
- **Implanted defibrillators/pacemakers = 11 patients**
  - **The rationale for not evaluating these patients was that the effect of pacing on atrial flutter is unknown and the presence of pacing might make the assessment of atrial flutter difficult.**
- **Persistent atrial fibrillation = 1 patient**
  - **Persistent atrial fibrillation might essentially "overdrive" the atrial flutter. This one patient developed atrial fibrillation shortly after the procedure and remained in that rhythm for the duration of the study.**
- **Withdrawn consent/lost to follow-up = 6 patients**
  - **These patients were determined to be not evaluable if they were lost to the study prior to 6 month follow-up.**
- **Death = 5 patients prior to the 6 month follow-up**
  - **These patients would have been evaluable if they had a recurrence of atrial flutter and were not on medications that would alter the assessment of that recurrence.**

6d. Adverse Events and Deaths

An adverse event was determined to be any undesirable experience occurring to a subject during the course of the study, whether or not it is related to the device or procedure. A major adverse event was defined as any clinical event (which occurred within the first week) following the use of the investigational device and was life-threatening; or resulted in permanent impairment of a body function or permanent damage to a body structure; necessitated significant intervention, such as major surgery, to prevent permanent impairment of a body function or permanent damage to a body structure; or required hospitalization or an extended hospital stay.

Major Adverse Events

Of the 250 patients treated with the Blazer II XP™ Cardiac Ablation Catheter and EPT-1000 XP™ Cardiac Ablation Controller and Accessories, twenty-two (22) major adverse events were reported in twenty (20) patients. The major adverse event rate (number of patients with the major adverse events per the number of patients in the study) was 8 % (20 /250). These events included lower extremity ischemia, cerebral infarct, thrombus (2 events), fractured femur, cerebral emboli, pulmonary embolism, hematoma, pseudoaneurysm (2 events) and AV fistula. Eight patients died during the study. Of the eight deaths, five occurred during the six-month study follow-up period, and all were related to underlying pre-existing conditions.

A detailed review of each adverse event was completed. Several patients had adverse events related to pre-existing non-cardiac disease. Several patients had adverse events related to having an invasive procedure but not relating specifically to the investigational device or ablation procedure. The table below details the major adverse events (AE) information.

Table 13

	Days post ablation	Adverse event
1		Atrial tachycardia
2	1	Pacer implant one day post ablation procedure for junctional rhythm *
3	2	Atrial fib
4	0	Laryngotracheitis due to traumatic intubation
5	0	Left buttock induration
6	3	Groin hematoma
7	0	Pulmonary embolus *
	3	Fractured femur
8	1	Systemic embolus to legs bilaterally, right popliteal and left tibioperoneal
9	1	Pacemaker implantation due to prolonged CSNRT
10	8	DVT
11	1	TIA
12	2	Right groin hematoma, possible thrombosed pseudoaneurysm
13	1	Transection femoral artery with subsequent AV fistula
14	1	Femoral AV fistula repair
15	2	Pseudoaneurysm/hematoma
16	5	Ablation for left atrial tachycardia
	6	CVA, multiple cerebellar infarcts
17	1	Atrial fib
18	4	CVA in patient with pre-existing cerebrovascular disease
19	4	Cholecystitis
20	1	Fever

All the adverse events above can be attributed to the procedure. The adverse events in two patients (*) could possibly be attributed to the use of the device for a rate of 2/250 or 0.8%.

Eight (8) patients died during the course of the study. The deaths were non-temporally related to the ablation procedure. Details regarding patient deaths are summarized below:

Table 14

Days death occurred post ablation	Death summary
345	79 year old man with CHF, s/p CABG 1994, collapse at home in shower, in asystolic arrest when ambulance on scene, autopsy showed AMI and cardiac hypertrophy
53	41 year old man with dilated cardiomyopathy, sudden collapse at work 53 days post ablation, in fine VF was cardioverted to junctional rhythm without perfusion, degenerated to asystole, no autopsy performed
38	71 year old woman with history of a total knee replacement developed a pulmonary embolus 10 hours post a successful ablation procedure which was performed without anticoagulation. This large left pulmonary artery embolus was associated with bilateral pleural effusions and a small pericardial effusion. She was treated with heparin and coumadin. She also fell after the ablation procedure, prior to d/c and sustained a periprosthetic left femur fracture, during treatment and recovery she developed MRSA sepsis from a CVP line, and died from complications
214	73 year old man s/p MI, hypertensive, COPD. Did not have a successful ablation procedure. He had worsening respiratory symptoms 6 months post ablation, and was admitted to a nursing home under hospice care. Death was thought to be due to pre-existing respiratory disease.
59	73 year old woman with hypertension, CHF, on CPAP at night had abrupt onset of severe SOB, chest pain and cough 60 days post ablation. Taken to ER where she rapidly deteriorated to cardiopulmonary arrest 3 hours after onset. No clear reason for death documented.
40	52 year old man with history of PVD, CAD, MI 1990, end stage cardiomyopathy, cardiogenic shock one month prior to ablation. He underwent a successful right atrial ablation for typical atrial flutter on 6/16/00. He continued to have left atrial tachycardia and underwent a second ablation procedure on 6/21/00 during which he had multiple bilateral infarcts in the posterior cerebellum. His neurological exam improved but he was transferred to hospice care because of ongoing CHF. Cause of death was thought to be due to worsening CHF.
15 months	74 year old man developed staphylococcal SBE of the mitral valve more than one year post successful ablation procedure.
30	48 year old woman died after a complicated elective gastric bypass surgery procedure.

6. Statistical Analysis

The table below summarizes the safety and effectiveness of the device when compared to the control group OPC for safety, acute success, and long-term success.

Table 15 – Comparison of Endpoints between EPT-1000 XP™ System Study and OPC

Endpoint	OPC		EPT-1000 XP™ Study	
	%	One-sided 95% Confidence Bound[1]	% (N)	One-sided 95% Confidence Bound[1]
Acute Procedural Success	88%	80%	94.0% (235/250)	91.5% (lower bound)
Major Complications	2.7%	7%	8.0% (20/250)	10.8% (upper bound)
Six-Month Success	88%	80%	96.0% (145/151)	93.4% (lower bound)

[1]Exact binomial using a commercially-available software package.

By comparing the lower bounds of the acute success (91.5% vs. 80%) and six-month success endpoints (93.4% vs. 80%), the results demonstrate that the EPT-1000 XP™ Cardiac Ablation System met the OPC for acute procedural success and six-month success rates. As previously explained, although the device exceeded the upper bound of major complications, review of the specific events revealed that most events were not device-related; accordingly, the adverse event rate was acceptable.

XI. CONCLUSIONS DRAWN FROM THE STUDY

Pre-clinical testing demonstrates that the Blazer II XP™ Cardiac Ablation Catheter and EPT-1000 XP™ Cardiac Ablation Controller and Accessories will maintain electrical integrity under the proposed conditions of use. Additionally, biocompatibility testing of the patient-contacting materials demonstrates the devices are biocompatible under the proposed conditions of use.

Clinical testing and statistical analyses demonstrates that the Blazer II XP™ Cardiac Ablation Catheter when used with the EPT-1000 XP™ Cardiac Ablation Controller is safe and effective for the treatment of Type 1 atrial flutter.

XII. PANEL RECOMMENDATION

Pursuant to the provisions of section 515(c)(2) of the Food, Drug, and Cosmetic Act (FD&C) as amended by the Safe Medical Devices Act of 1990 (SMDA 1990), this PMA

application was not referred to the Circulatory System Devices Panel, an FDA advisory panel committee, for review and recommendation because the information in the PMA is similar to information previously reviewed by this panel.

XIII. CDRH DECISION

CDRH issued an approval order on August 25, 2003. The applicant's manufacturing facilities were inspected on May 8, July 10 and 11, 2001, September 26 and November 26, 2002, and June 3, 2003 and found to be in compliance with the device Quality System Regulations (Part 820).

XIV. APPROVAL SPECIFICATIONS

Directions for Use: See Labeling (Information for Use)

Hazards to Health from Use of the Device:
See INDICATIONS, CONTRAINDICATIONS, WARNINGS AND PRECAUTIONS, and ADVERSE EVENTS in the labeling (Information for Use).

Post Approval Requirements and Restrictions: See approval order.